

REMARKS

By the present Amendment, claims 1 and 18 have been amended. No claims have been added or cancelled. Accordingly, claims 1-9, 11-29, and 31-34 remain pending in the application. Claims 1, 18, and 29 are independent.

In the Office Action of November 23, 2010, claims 1-9, 11-28, and 31-24 were rejected under 35 USC §103(a) as being unpatentable over U.S. Patent No. 6,368,277 issued to Mao et al. ("Mao") in view of U.S. Patent Application No. 2003/0013964 to Bjaerum et al. ("Bjaerum"). This rejection is respectfully traversed.

The Examiner's indication that claim 29 is allowed, is noted with appreciation.

Claims 1-9, 11-28 and 31-24 were rejected under 35 USC §103(a) as being unpatentable Mao in view of Bjaerum. Regarding this rejection, the Office Action indicates that the Office Action indicates that Mao discloses an image diagnostic apparatus that comprises imaging means for producing a tomographic image of an object to be examined, a storing unit of storing a moving image formed by a plurality of frames of the tomographic image, and a display unit for displaying the moving image. The Office Action further asserts that Mao discloses an operation unit for designating a desired portion of the tomographic image with a mark, and tracking means for making the mark follow the desired portion of the tomographic image from image information of the desired portion.

The Office Action admits that Mao fails to expressly disclose the tracking means storing coordinates of at least two designated portions. The Office Action further admits that Mao fails to disclose calculating shift of distance over time and displaying it as a graph on the display unit. Bjaerum is relied upon for disclosing that the tracking means stores coordinates of at least two designated portions, calculates shift of distance over time, and displays it as a graph on the display unit. The Office

Action concludes that it would have been obvious to modify the teachings of Mao with the tracking means of Bjaerum in order to arrive at the claimed invention.

Applicants respectfully disagree.

As amended, independent claim 1 defines an image diagnostic apparatus that comprises:

- imaging means for producing a tomographic image of an object to be examined;

- a storing unit of storing a moving image formed by a plurality of frames of the tomographic image;

- a display unit for displaying the moving image;

- an operation unit for designating at least two portions of the tomographic image with marks; and

- tracking means for making the marks follow the desired portions of the tomographic image based on image information of the desired portions derived from image processing between two said frames of the tomographic image,

- wherein the tracking means:

- stores coordinates of at least two designated portions input from the operation unit after movement,

- calculates at least any one of a distance between the two designated portions, a shift of the distance, a shift speed of the distance, and a change rate of the distance,

- and displays it as a graph on the display unit.

The image diagnostic apparatus of independent claim 1 includes an imaging means for producing a tomographic image of an object to be examined, a storing unit for storing a moving image formed by a plurality of frames of the tomographic image, and a display unit for displaying the moving image. The image diagnostic apparatus also includes an operation unit for designating at least two portions of the tomographic image with marks, and a tracking means which causes the marks to follow the desired portions of the tomographic image based on image information of the desired portions. The image information of the desired portions is also derived

from image processing between two frames of the tomographic image. According to independent claim 1, the tracking means stores coordinates of at least two designated portions that are input from the operation unit after movement, and calculates either a distance between the two designated portions, a shift of the distance, a shift speed of the distance, a change rate of the distance, or various combinations thereof. The tracking means subsequently displays the results of the calculation as a graph on the display unit.

As discussed in the Specification, the most coincided local image (27max) is extracted from among a plurality of searched local images (27). See paragraphs [0035] - [0041] of the published application. The local image (27max) is determined as the position of the cutout image (25) after movement, and a coordinate of local image (27max) is found. Next, the difference between the coordinates of local image (27max) and of cutout image (25) is calculated, the coordinate of a designated point (23) after movement is calculated based thereon and stored. It is then superposed on frame image f1 displayed on the display unit (2). The movement information calculating unit (5) calculates various measured information concerning movement of the designated point (23), such as tissue movement of the designated portion, based on the coordinate of the designated point (23) after movement calculated. The movement information calculating unit 5 further displays the measured information concerning the movement of designated point (23) and its shift based on the calculated measured information on the display unit. According to such an arrangement, it becomes possible to obtain quantitative measurement of the moving direction and distance based on the coordinates of the designated portion before and after movement. Additionally, it is possible to quantitatively calculate measured

information such as physical quantity concerning a moving distance, a moving speed, a moving direction, etc. of the designated portion.

The office Action alleges that the combination of Mao and Bjaerum discloses all of the features recited in the claimed invention. As admitted in the Office Action, Mao fails to disclose features recited in independent claim 1, such as storing coordinates of at least two designated portions, calculating shift of distance over time, and displaying it as a graph on the display unit. Review of Bjaerum, however, has revealed various differences from the features alleged to be disclosed. More particularly, Bjaerum discloses an ultrasound apparatus that generates a pattern of indicia corresponding to tracked moving structure, such as a cardiac wall tissue. The pattern of indicia is generated by displaying a set of tagging symbols related to the tracked movement of the structure over a time period by an apparatus comprising a front-end that generates received signals in response to backscattered ultrasound waves. The ultrasound apparatus includes a Doppler processor which generates a spatial set of signals values representing movement within the structure, and a non-Doppler processor which generates a set of parameter signals representing a spatial set of B-mode values within the structure. A host processor is used to executed a tracking function to generate a set of tracked movement parameter profiles and motion parameter profiles over a time period corresponding to anatomical locations associated with the set of tagging symbols.

Contrary to the assertions made in the Office Action, Bjaerum does not disclose a tracking means capable of performing the features recited in independent claim 1. Rather, visualization and assessment of the displacement of wall tissue is provided in the form of a distance moved by the structure or deformation of the moving structure. The moving structure is characterized by a pattern of indicia (set

of tagging symbols) that is overlaid onto an image of the moving structure.

Characterization of the moving tissue is accomplished, in part, by generating a set of signal values derived from movement of the structure, such as mean longitudinal velocity and tracks of the isolated tissue sample along the direction of the ultrasound beam. See paragraph [0020]. Bjaerum is only capable of detecting tissue movement in one direction, i.e., the longitudinal direction along the ultrasound beam. Consequently, it is not possible to detect any tissue movement in different directions, particularly in a direction orthogonal to the longitudinal direction. Thus, even when combined with the teachings of Mao, the resulting combination still fails to provide any disclosure or suggestion for features recited in independent claim 1, such as:

wherein the tracking means:

stores coordinates of at least two designated portions
input from the operation unit after movement,

calculates at least any one of a distance between the two
designated portions, a shift of the distance, a shift speed of the
distance, and a change rate of the distance,

and displays it as a graph on the display unit.

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claims 2-9, 11-17, and 34 depend from independent claim 1, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

As amended, independent claim 18 defines a tissue movement tracking method that comprises:

a first step of displaying a one frame image of a moving image
formed by producing tomographic images of an object to be examined;

a second step of setting a designated portion by inputting a command to superpose a mark on the designated portion of a tissue the movement of which is tracked in the displayed one frame image;

a third step of setting a cutout image of a size including the designated portion in the one frame image;

a fourth step of searching another frame images of the moving image and extracting a local image of the identical size which is most coincided with the cutout image;

a fifth step of calculating a coordinate of the designated portion after movement based on a coordinate difference between the most coincided local image and the cutout image;

making the mark follow desired portions of the tomographic image based on image information of the desired portions derived from image processing between two said frames of the tomographic image;

storing at least two designated portions are set and coordinates of the two designated portions after movement; and

calculating at least any one of a distance between the two designated portions, a change of the distance, a change speed of the distance, and a change rate of the distance.

Independent claim 18 has been amended to incorporate features similar to those recited in independent claim 1. In particular, the method now includes a step of making the mark follow desired portions of the tomographic image based on image information of the desired portions derived from image processing between two said frames of the tomographic image. Additionally, a calculation is made to determine at least any one of a distance between the two designated portions, a change of the distance, a change speed of the distance, and a change rate of the distance. As previously discussed with respect to independent claim 1, the art of record fails to provide any disclosure or suggestion for such features.

It is therefore respectfully submitted that independent claim 18 is allowable over the art of record.

Claims 19-28 and 31-33 depend from independent claim 18, and are therefore believed allowable for at least the reasons set forth above with respect to

independent claim 18. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

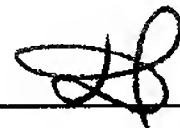
For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 529.44777X00).

Respectfully submitted,
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Dated: February 23, 2011